User manual

ELSTER F2 Calculator

A small competent calculator for compact or wall mounting

User manual F2

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1 Installation

1.1 At delivery

F2 is delivered in the *transport mode*. This means that only the real time clock is active. No measurements take place in this position. The *transport mode* is indicated by a "no" in the upper left hand corner.

Before installation commences the meter is to be set in the *operating mode*. This is done by pressing and holding the push button for approximately five seconds, and thus entering one of the following two modes:

1. *Service mode*: Normally the calculator is set to enter the *service mode*. Here it is possible to alter certain parameters in the calculator. See also ***4. Service***. To indicate that the meter has left *transport mode*, "no" on the display extinguishes and is replaced by "00" - *service mode*.
2. *Operating mode*: If so ordered, the F2 calculator is set to enter the *operating mode* directly. To indicate that the meter has left *transport mode*, "no" on the display extinguishes and is replaced by "10" - *operating mode*. To enter the *service mode* from *operating mode*, please cf. ***4. Service.***

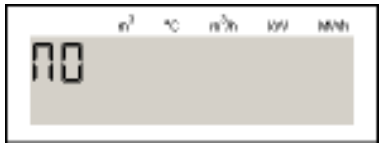

Fig. 1.1a, Transport mode

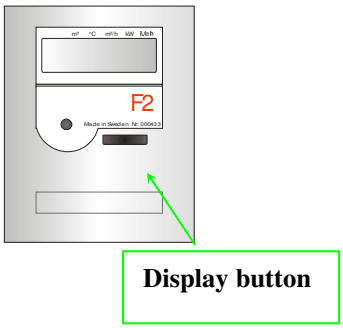

Fig. 1.1b, F2 display button

Note: In order to complete the installation the integrator must be set to *operating mode*.

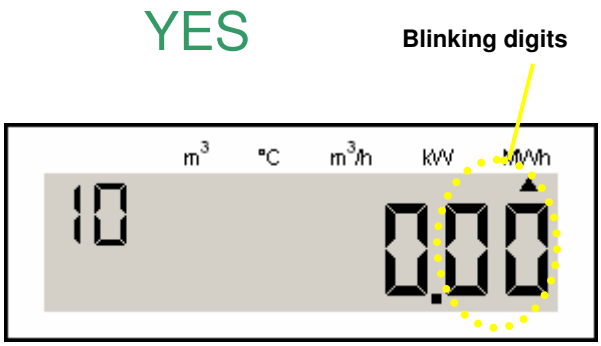

Fig. 1.1c, Operation (normal) mode. The calculator must be set into this mode in order to measure

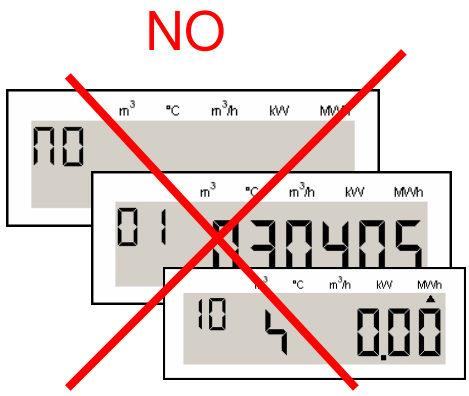

Fig. 1.1d, NOT operation mode

Upper display Transport mod
middle display Service mode
Lower display Test mode

1.2 Connections

The screw terminal blocks are situated under the cover on the rear side of the calculator.
Note: The covers retaining screws is protected by a labelled sea.

When the calculator is mains powered the will be a permanent power cord.

Note: BR431 power supplied, flow sensor has to be connected to +3V.

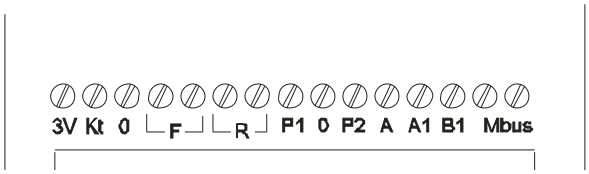

Fig. 1.2a, Connection terminal F2

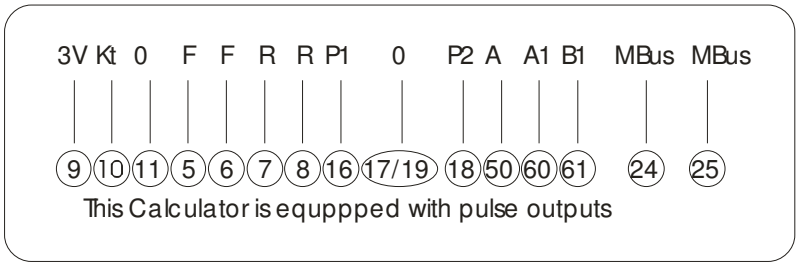

Fig. 1.2b,Labels on the on the backside of the F2 cover. The picture on top F2 with pulse outputs and the picture below F2 with pulse inputs.

Numbering according to EN1434	Marking on terminals	Description
9	3V	Flow sensor power supply (+)
10	Kt	Flow sensor(+)
11	0	Flow sensor (-)
5	F	High temperature sensor (H)
6	F	High temperature sensor (H)
7	R	Low temperature sensor (L)
8	R	Low temperature sensor (L)
16	P1	Pulse input/output 1 (+)
17/19	0	Pulse input/output 1 and 2 (-)
18	P2	Pulse input/output 2 (+)
60	A1	Siox input (option)
61	B1	Siox input (option)
24	MBUS	M-Bus input
25	MBUS	M-Bus input

2 Mounting

F2 can be mounted either on the flow sensor or wall mounted. When the calculator is mounted on the flow sensor, the adapter provided for this purpose has to be used.

2.1 Mounting on a flow sensor

The adapter allows the calculator to be mounted vertically or horizontally, see fig. 2.1. Fixate the calculator by pulling the screw tight.

1. Screw for fixating the adapter
2. Guide rails
3. Adapter

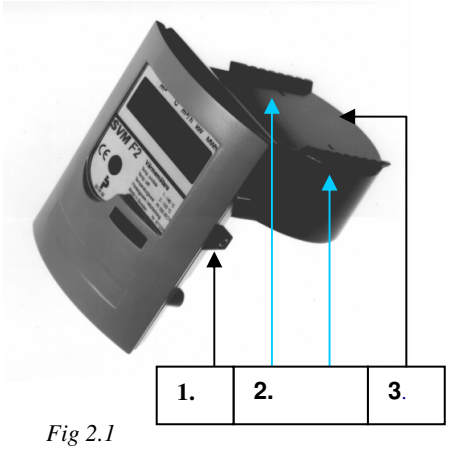

Fig 2.1

2.2 Lead-through

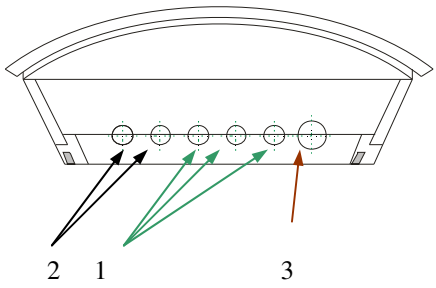

Fig. 2.2,

F2 has six holes for connecting cables. To obtain the environmental class, it is vital that the diameter of cables is of the following sizes:

1. Connection flow sensor, temperature sensors, Ø4.3 ± 0.2 mm.
2. Spare (communication) Ø4.3, ± 0.2 mm.
3. Cable for mains, Ø6.4, +0,-0.2 mm.

2.3 Dimensions

All dimensions are in [mm].

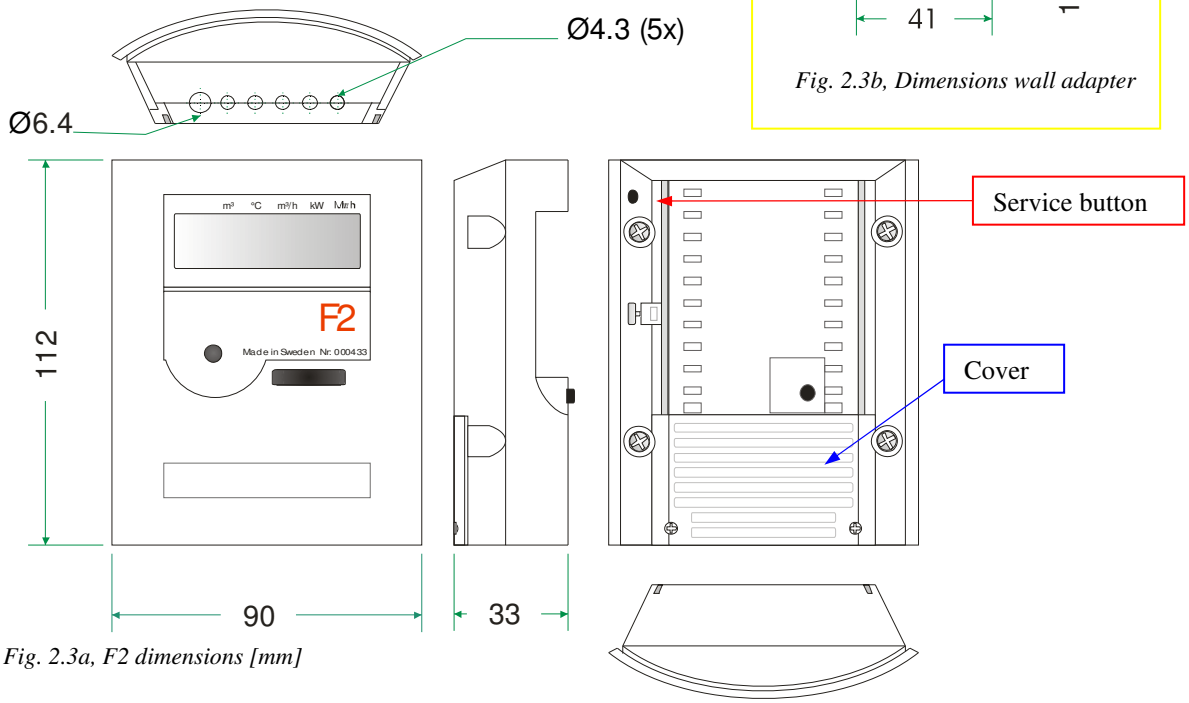

Fig. 2.3a, F2 dimensions [mm]

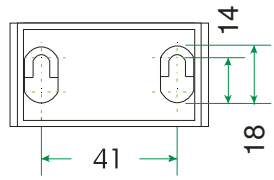

Fig. 2.3b, Dimensions wall adapter

2.4 Installation test

When installation has been completed simple test can be done to verify that the calculator has been installed correctly. Wait until the flow sensor supplies a pulse. This shall result in the symbol for flow sensor pulse, a square shown on display will flashing once. Check the display of the correct temperature. Check that the built-in real time clock is working correctly. If there is a need to change anything, see the chapter service.

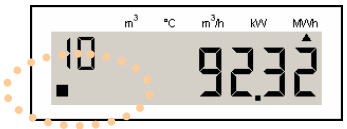

Fig. 2.4a, Flow pulse indicator

Fig. 2.4b, Display sequence ”15” error codes

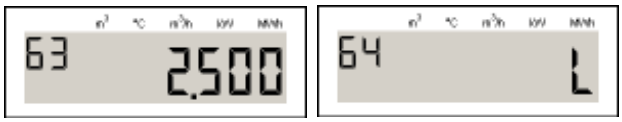

Fig. 2.4c, Display sequence “63” pulse value flow sensor “63” flow sensor placing

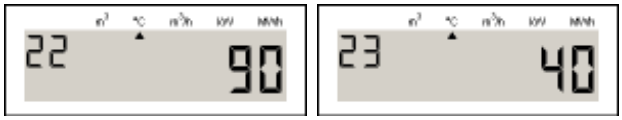

Fig. 2.4d, Display sequence temperature sensors, “22” high (H) and “23” low (L)

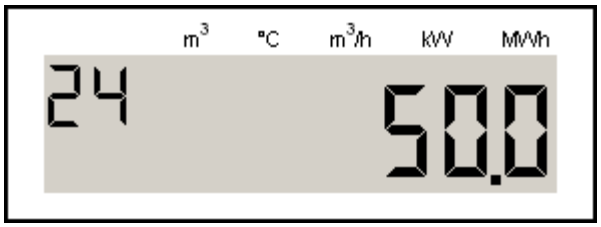

Fig. 2.4e, Display sequence “24”, temperature difference

2.5 Momentary values

Momentary power, display sequence ”20”, and momentary flow, display sequence ”21”, are calculated as follows: As long as the time between the flow sensor pulses is longer than four seconds, flow and power are calculated for each flow sensor pulse. When the time is less than four seconds, the pulses are summated for approximately four seconds, where after calculation takes place.

3 Handling

3.1 Display

The F2 has an LCD (Liquid Crystal Display), see fig. 3.1a below. The values are displayed in sequences. The left-hand sequence digit shows the relevant sequence.
The right-hand sequence digit shows which value in the sequence is being displayed. A short button depression results in a move to the next value in the relevant sequence.

To change sequence, keep the pushbutton depressed until the left-hand sequence digit starts to increment. Release the button at the required sequence. Change of values in the selected sequence takes place as described above.

If no button depression occurs during a predetermined period of time the display will revert to normal position after 60 seconds.

The display is configured as below:

1. sequence digits
2. Flow sensor pulse indicator
3. Relevant value shown here, maximum 7 digits
4. Arrow that indicates unit for displayed value

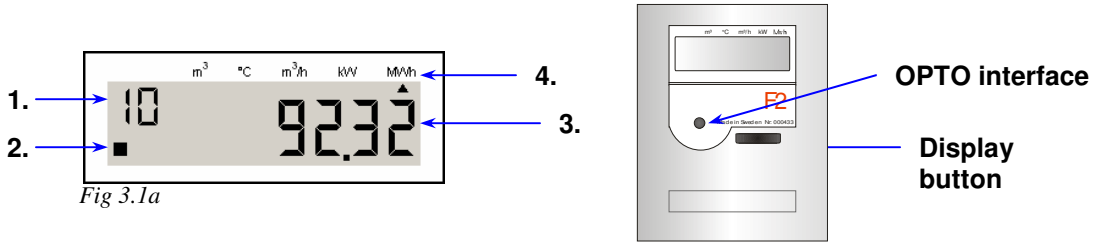

Fig 3.1a

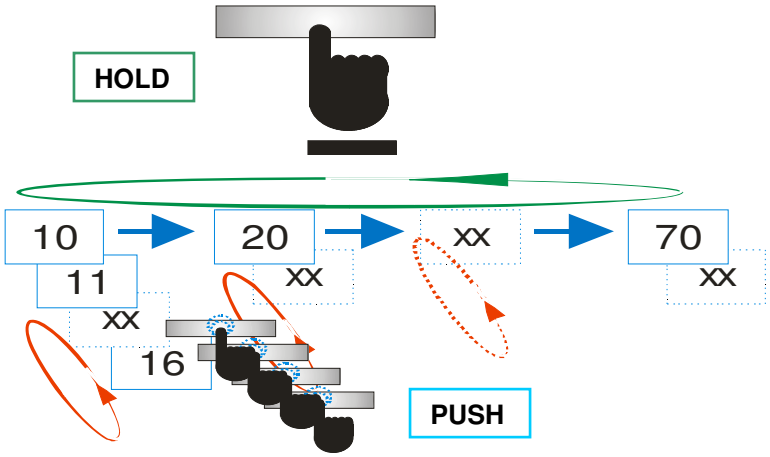

Fig. 3.1b, Push to toggle to next value. Hold to enter next sequence.

3.2 Display sequence table

	Description
10	Accumulated energy (Default position)
11	Accumulated volume according to flow sensor1
12	Display test
13	Accumulated volume for pulse input 1 (Only when F2 fitted with pulse inputs)
14	Accumulated volume for pulse input 2 (Only when F2 fitted with pulse inputs)
15	Error code, see Error code
16	Error time, [Minutes]
20	Momentary power
21	Momentary flow
22	High temperature, 0 decimals
23	Low temperature, 0 decimals
24	Temperature difference, 1 decimals
30	Account days[2], when values are stored, [YYMMDD]
31	Account days[2], Accumulated energy
32	Account days[2], Accumulated volume according to flow sensor
33	Account days[2], Accumulated volume according to energy calculation
34	Account days[2], Accumulated volume pulse input 1, [m3]
35	Account days[2], Accumulated volume pulse input 2, [m3]
36	Possible error code, at time of storage of account days
37	Possible accumulated error time, at the time of storage account days, [Minutes]
3x	Following account days registers (loop back)
40	Monthly registers[3], date when values are stored, [YYMMDD]
41	Monthly registers[3], Accumulated energy
42	Monthly registers[3], Accumulated volume according to flow sensor
43	Monthly registers[3], Accumulated volume according to energy calculation
44	Monthly registers[3], Accumulated volume pulse input 1, [m3]
45	Monthly registers[3], Accumulated volume pulse input 2, [m3]
46	Possible error code, at time of storage of monthly register
47	Possible accumulated error time, at the time of storage, [Minutes]
4x	Following monthly registers (loop back)
50	Operating time, [Hours]
51	Relevant date, [YYMMDD]
52	Relevant time, [HH.MM]
53	Recommended date for battery replacement, [YYMMDD]
60	Communication address, Primary address
A0	Communication address, Secondary address (normally same as meter S/N)
bx	Calculator serial number (S/N)[4]
63	Pulse value [l/p]
64	Placing of flow sensor, [H/L], L = Low
70	Accumulated volume corresponding to accumulated energy
73	Last remote read accumulated energy
74	Time since latest remote read accumulated energy, [Hours]
75	Accumulated total error time, [Minutes]

1 The calculator has two registers for accumulated volume. Value 11, is incremented at the rate of arrived flow pulses. The other register, value 70 is incremented in conjunction with energy calculation.

2 In order to change to the next account day, keep pushing the button until the date starts to increment, then release the button. After the display 37, see table above, the next account day will display. Note: If the "Push button" is held again, the display reverts to default position (seq. 10).

3 To change to another month, keep pushing the button until the date starts to increment. Release at the requisite month. After display 47, see above, the next stored date will be displayed. Note: If the "Display button" is held again, the display reverts to default position (seq. 10).

3.3 Error codes

Error codes are shown in display sequence ”15”.

Code	Description
0001	**Break in low temperature sensor (L)**
0002	**Short circuit in low temperature sensor (L)**
0004	**Break in high temperature sensor (H)**
0008	**Short circuit in high temperature sensor (H)**
0005	Error code combination 0001 + 0004
000A	Error code combination 0002 + 0008
0040	**Low flow**
0080	**Mains power failure**
0100	**Battery replacement recommended**

Fig. 3.3, Display sequence “15”error codes

4 Service

Certain parameters in F2 can be altered using the display button when F2 is set in the service mode. Procedure to enter the service sequence:

1. Hold the service button on the rear side of the calculator pressed by using a small screwdriver. A seal protects the service button.
2. Then hold the display button pressed for 5 seconds.
3. First release the display button the release the service button.

The calculator will be set to service sequence and the display will show ”00” as confirmation.

To leave the service mode, use the same procedure as entering the service mode.

Note The altered values are not stored until the next sequence is displayed. Example, changing the real time clock it’s necessary to proceed to date before leaving the service mode.

Manoeuvre in service sequence, and changing values

By pushing the display button the value for the blinking digit can be altered. To change next digit “HOLD” the display button pressed until next digit starts to blink. To change service sequence “HOLD” the display button pressed until next service sequence is reached.

00: Time

”00” is the real time clock is the format HHMM.

01: Date

”01” the relevant date in the format ”YYMMDD”.

02, 03: Pulse value

”02” and ”03” pulse value for flow sensor. ”02” pulse value and ”03” decimals for pulse value.

Example 1 The pulse value shall be 2.5 [l/p]. “02” shall be 2500, and ”03” shall be 3. E.g. 2500 with 3 decimals = 2.5 [l/p].

Example 2 The pulse value shall be 10 [l/p]. “02” = 1000, ”03” = 2. E.g. 10 [l/p].

04, 05: Account days

”04” and ”05” are account days with the format MMDD. F2 can store two. To deactivate the account days set, MMDD to “0000”.

06: Communication address
”06” set communication address. The address is set with four digits.
Example: Address 5 is set as ”0005”.

07: Reset the accumulated error time
”07” the error time can be reset. Format “0 or “1”.
0 = Reset error time
1 = Do not reset error time

08: Flow sensor placing
”08” set flow sensor placing, format ”0” or ”1”.
0 = Flow sensor installed in low
1 = Flow sensor installed in high

09: Recommended date for battery replacement
”09” sets the battery replacement date, format YYMMDD.

0A: Exit service mode
It is possible to leave service mode without breaking the service seal.
In sequence ”0A” depending on which value is set:
0 = Reset error time
1 = return to service sequence “0”

4.1 Service sequence table

Service sequence	Description
00	Time [hhmm]
01	Date [YYYMMDD]
02	**Pulse value for flow sensor, Without decimal placing, 4 digits**
03	**Pulse value decimal placing, 0-4**
04	Account days 1, MMDD
05	Account days 2, MMDD
06	Primary communication address, set with 3 digits), e.g. ”5” is set ”005”.
07	Reset stored error time 0 = Reset stored error time (default) 1 = Do not reset error time
08	Flow sensor placing, 0 = Installed at low end (L) 1 = Installed at high end (H)
09	Recommended battery replacement date [YYMMDD] Do not change without consulting with ELSTER .
0A	**Exit service sequence, 1 = EXIT 2 = return to service sequence ”00”**

Table 4.1, Service sequence,
hh – hour, mm –minute, YY – Year, MM – month, DD – Day

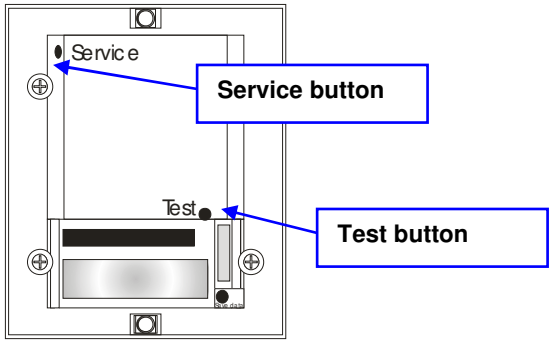

Fig. 4.1a, Service and test buttons

Fig. 4.1b, Test key

Note: The display sequence in the ”Service mode” may vary depending on calculator configuration.

5 Verifying the calculator

Verification of the calculator's measurement accuracy is undertaken in the test mode, where the energy value/flow sensor pulse is issued via the HF-output at the service adapter. For each flow sensor pulse, measurement takes place on the temperature sensors and a pulse burst corresponding to the measured energy of the meter is issued.

To test (verify) the measurement accuracy of the calculator by means of HF-pulses proceed as follows:

1. While short circuiting the test button with a “Test key”, see fig. 4.1a and 4.1b, hold the “Push button” until the display mode changes.
2. The calculator now enters test mode. This is indicated by a flash symbol being displayed.
3. Connect fixed resistance for simulation of Pt100 via terminal block units Nos. 5-6 (flow) and 7-8 (return).
4. Connect a pulse generator via terminal block unit Nos. 10-11 (connection 11 is ground) in order to simulate flow sensor pulses. Note: Voltage level is max. 3V.
5. Connect an OPTO-head/interface with HF-pulse interface at the front.
6. Simulate a flow sensor pulse after which the meter issues an (approximately) 20 kHz pulse burst corresponding to 100*k*dt pulses via the HF-output. “k” is the energy factor. (kWh/°C/m3) and dt is the difference between simulated flow and return temperatures.

   Example: Rf=138.50 (100.00°C), Rr=127.07 (70.00°C) => dt=30.00°C, k=1.141 gives 100*1.141*30 = 3423 pulses
7. The next flow sensor pulse can be sent immediately after the HF-pulse burst from the meter has been dispatched.

To leave test mode proceed as follows:

1. While short circuiting the test button hold the “Display Button”, see fig.1.1b.
2. The calculator now enters operation mode.

To verify (test) the measurement accuracy of the meter with help of the display, first set up connections in accordance with points 3 and 4 above for testing by means of HF-pulses. Testing is undertaken in the meter's operation mode. Proceed as follows:

1. Supply flow sensor pulses until the energy display is incremented one step.
2. Supply flow sensor pulses with a maximum frequency of 12 Hz until the display has been stepped appropriate numbers of steps.
3. Errors in testing decrease with the number of steps made during the test. If the meter is programmed for 1.0 litre/pulse and resolution for display of energy is 0.001MWh, this means that 10 steps on the display correspond to 288.85 pulses from the flow sensor with selected temperatures in accordance with the above. The testing error is maximum + - 1 pulse, which, in the example, corresponds to 0.35%.

6 Seals

1. Service seals
2. Test seal
3. Electronic seal
4. Installation seals

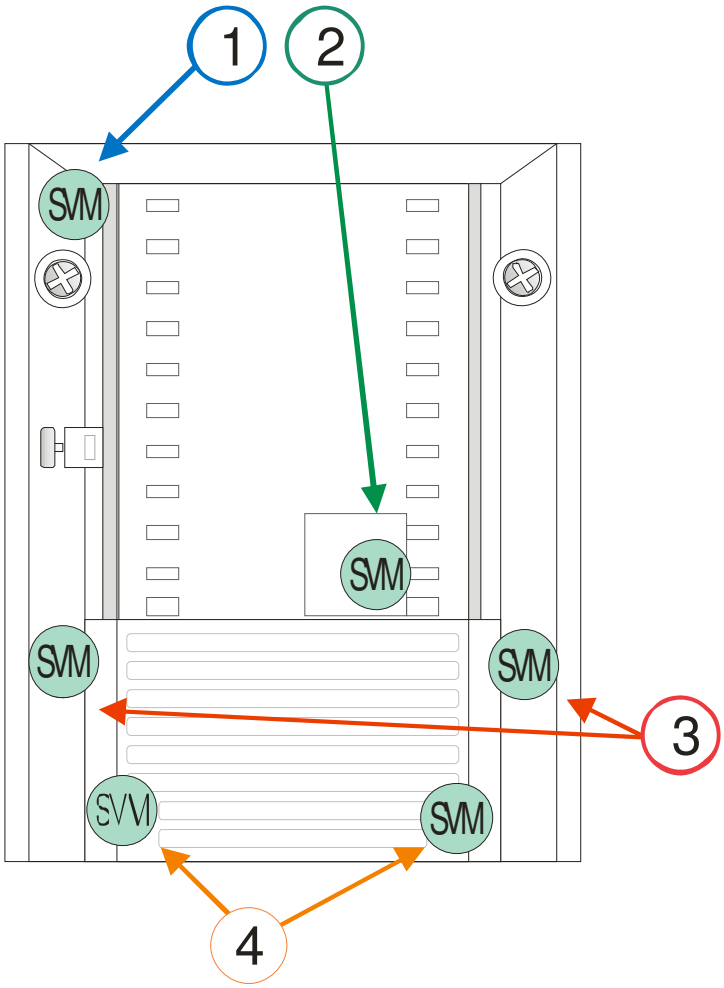

Fig. 6, Sticker seals

7 Technical data

7.1 Power supply

Battery	3V – 2,2Ah Operation time max. 10 years
Mains	230V±10%, 45-65Hz

Table 7.1, Power supply

7.2 Temperature sensors

Approved and matching pares of temperature sensors of the type Pt 100 or Pt 500 are to be used. Maximum sensor current (RMS) 4 µA for PT100

Cable area [mm^2]	Maximum cable length for PT100 sensors [m]
0.22	2.5
0.50	5.0
0.75	7.5
1.50	15.0

Table 7.2, Cable areas for Pt100

7.3 Flow sensors

Flow sensor with pulse output.

Max. frequency [Hz]	12
Pulse value range [l/p]	0.0001-9999
Min. pulse length [ms]	40
Max. voltage [V]	3
Max. cable length [m]	15

Table 7.3, Technical specifications

7.4 Temperature range

Temperature range	0 - 190°C
Temperature difference	2 – 120K

Table 7.4, Temperature range

7.5 Ambient temperature & temperature class

F2 complies with the prerequisites for Environmental Class C according to EN1434.

Ambient temperature storage/transport	-20°C to +70°C
Ambient temperature operation	+5°C to +55°C

Table 7.5. Ambient temperature ranges

7.6 Flow sensor placing

F2 can be configured for flow sensor placement in high or low end of the pipe (supply or return pipe). This is marked H = high or L = low in display sequence “64”.

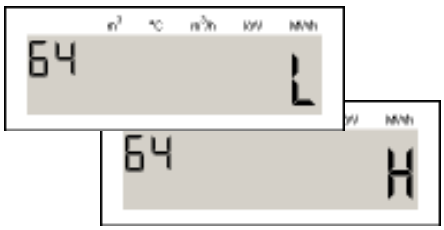

Figure 7.6, Flow sensor placing

7.7 Maximum values for power

The values below are valid for energy unit [MWh] and standard decimal setting

Pulse value [l/p]	Maximum power [MW]
1.0	3.3
10.0	33.0
100.0	330.0
2.5	3.3
25.0	33.0
250.0	330.0

Table 7.7, maximum power at pulse values

7.8 Dynamic behaviour

Measurements are undertaken for each flow sensor pulse, provided the time between the pulses is five (5) seconds or longer. If the time between pulses is less than five seconds, measurement takes place each five seconds. When the period between the flow sensor pulses exceeds 60 seconds, a measurement takes place every 60th seconds, where only the temperatures are updated.

7.9 Data output interface

M-Bus acc. to EN1434-3	Via OPTO-interface (EN60870-5) bus connection (terminals)

Table 7.9, data output interfaces

7.10 Pulse outputs

(either pulse outputs or pulse inputs on F2)

F2 can be equipped with two pulse outputs as standard of the type “Open collector” for energy (pulse output 1) and volume (pulse output 2).

The last digit and the energy unit will reveal the pulse weight of the pulses. Example: sequence “10” (energy) on display is shown “1001.01” MWh => pulse weight = 0.01 MWh/pulse.

Pulse output 1
Energy; one (1) pulse for each update of the last digit in the energy register (seq. “10”).

Pulse output 2
Volume, one (1) pulse for each update of the last digit in the flow register (seq. “11”).

Pulse value	[ms]	250
Voltage	[V]	3 – 30
Maximum current	[µA]	20

Table 7.10, Pulse output data

7.11 Pulse inputs

(either pulse outputs or pulse inputs on F2)

F2 is equipped with two pulse inputs as standard. The pulse inputs can be used for measuring of other meter with pulse outputs, such as cold and hot water meters, gas, electricity meters and other meters. The pulse inputs can be set as volume registers. These registers accumulate the pulses into two volume registers with the value [m3].

Frequency	[Hz]	12
Min. pulse duration	[ms]	40
Max. Voltage	[V]	3

Table 7.11, Pulse inputs

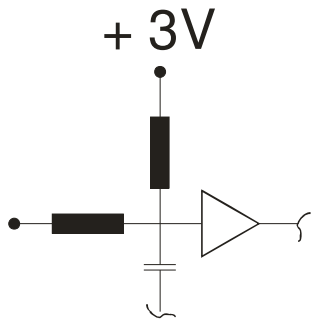

Fig. 7.11, Pulse output

7.12 Alarm output

The F2 is equipped with one alarm output as standard of the type “Open collector”. The alarm output sends a pulse every hour as long as an error code exists. The pulse duration 250 [ms] for pulse and alarm output can be altered using the “Service program” version 2 or higher in 125 [ms] steps.

Alarm frequency when an error exists		Once every hour
Pulse width	[ms]	250

Table 7.12, Alarm output

8 Appendix

8.1 Decimal placing F2

The decimal setting for F2 follows a ”de facto” standard for utilities

Pulse value [l/p]	MWh	GJ	m^3	KWh	MBTU	kW	m^3/h	m^3
1.0	0.001	0.001	0.001	0.1	0.001	0.01	0.001	0.001
10	0.01	0.01	0.01	1	0.01	0.1	0.01	0.01
100	0.1	0.1	0.1	-	0.1	1	0.1	0.1
1000	1	1	1	-	1	1	1	1
2.5	0.001	0.01	0.01	0.1	0.01	0.01	0.001	0.01
25	0.01	0.1	0.1	1	0.1	0.1	0.01	0.1
250	0.1	1	1	-	1	1	0.1	1
2500	1	1	1	-	1	1	1	1

Table 8.1, Options marked "-" should not be used.

8.2 Article number F2

F2 ABCDEFGHIJ KLM

A	1	Pt100 2-wire measurement, flow in low temperature
A	2	Pt100 2-wire measurement, flow in high temperature
A	5	Pt500 2-wire measurement, flow in low temperature
A	6	Pt500 2-wire measurement, flow in high temperature
B	1	Battery supply
B	2	Bus supply
B	3	Mains supply 230VAC
B	5	24 VAC
C	0	Kt Input 2.5 l/p
C	1	Kt Input 25 l/p
C	2	Kt Input 250 l/p
C	3	Kt Input 2500 l/p
C	4	Kt Input 1 l/p
C	5	Kt Input 10 l/p
C	6	Kt Input 100 l/p
C	7	Kt Input 1000 l/p
C	8	KWh
D	A	MWh
C	B	GJ
C	C	MBTU
D	0	Standard order
D	1	Special, Extra information at the order, e.g. customer information
D	2	Pulse Inputs, 2.5 l/p, dec. 2
D	3	Pulse Inputs, 25 l/p, dec. 1
E	-	Pulse Inputs, 250 l/p, dec. 0
E	S	Pulse Inputs, 1 l/p, dec. 3
F	1	Pulse Inputs, 10 l/p, dec. 2
F	2	Pulse Inputs, 100 l/p, dec. 1
F	3	Pulse Inputs, 1000 l/p, dec. 0
F	5	Pulse Outputs
F	6	Backlight on display (not recommended on battery supplied meters)
F	7	No Backlight
F	8	For wall mounting, with adapter incl.
F	9	Compact mounted with Hydrometer BR431
G	0	Compact mounted with other flow sensor, with adapter incl.
G	1	With adapter for BR471
G	4	Without adapter
G	5	Standard
H	0	Standard
H	1	Country code, 3 = Standard English
H	2	Standard
H	3	Standard
H	4	Pt100 2-wire measurement, flow in low temperature
I	-	Pt100 2-wire measurement, flow in high temperature
J	1	Pt500 2-wire measurement, flow in low temperature
K	1	Pt500 2-wire measurement, flow in high temperature
L	0	Battery supply
M	0	Bus supply

Table 8.2, Article numbers for F2 calculator. All combinations are not available.

8.3 Data output table

The following data are accessible via the data output:

Data	EN 60870-5	Manufacturers specific	SIOX (option)
Flow sensor placing	X		X
Program version	X		X[1]
Manufacturer	X		
Communication address	X		X
Meter number	X		
Error code (limited)	X		X
Accumulated energy	X		X
Accumulated, volume 11	X		X
Accumulated, volume 22	X		
Flow temperature (high)	X		X
Return temperature (low)	X		X
Temperature difference	X		X
"Operation time" (operation time, error time)	X		
Momentary flow	X		X
Momentary power	X		X
Time and date	X		
Pulse register for pulse input 1	X		
Pulse register for pulse input 2	X		
Monthly values3 data storage			
Monthly values3 accumulated energy	X		
Monthly values3 accumulated volume 11	X		
Monthly values3 accumulated volume 22	X		
Account days, same as monthly values, see above	X		
High resolution energy			
High resolution volume 11	X		
High resolution volume 22		X	X
Relevant error code		X	X
Accumulated time for relevant error		X	
Previous error code		X	
Previous accumulated time for relevant error		X	X[2]
Manufacturing number		X	
Pulse value		X	
Latest read energy via communication		X	
Time [h] since latest reading		X	
Recommended date for battery replacement		X	
Error codes and accumulated error times during storage (see monthly registers and account days above)		X	
Flow sensor placing		X	
Program version		X	

Table 8.3, Data output

1. As per flow sensor
2. Corresponding to energy registers
3. 37 registers
4. –
5. For being compatible towards existing system, the version number is fictitiously set to four
6. Total error time
7. The option board can be configured to display pulse value units

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